

U.S. Application of Cleland et al.
POWERED OPENING MECHANISM AND CONTROL SYSTEM

What is claimed is:

1. A powered closure drive mechanism for a vehicle, comprising:

a controllable strut mountable between a frame of a vehicle and a closure pivotally connected to the frame, said strut having opposite ends moveable in opposite directions toward and away from one another, said strut having a lock which, when in a locking condition, substantially prevents movement of the opposite ends of said strut relative to one another, and, when said lock is in a releasing condition, allows movement of the opposite ends of said strut relative to one another, the opposite ends of said strut being biased when said lock is in the releasing condition to move away from one another, an angular orientation of said strut being adjustable between orientations in which the bias of the strut overcomes a weight of the closure so as to move the closure in an opening direction, and orientations in which the weight of the closure overcomes the bias of the strut so as to move the closure in a closing direction;

a motor assembly operatively coupled with said strut so as to adjust the angular orientation of the strut by moving one of said opposite ends and, thereby, to effect opening and closing movement of the closure;

a dynamic property detector that detects one or more dynamic properties of the closure; and

a controller operatively coupled to said motor, said lock, and said dynamic property detector, said controller controlling said motor and said lock based, at least in part, upon said one or more dynamic properties detected by said dynamic property detector.

2. The powered closure drive mechanism of claim 1, wherein said strut includes restricted orifice structure constructed and arranged to allow restricted flow of strut working fluid across a piston of said strut as said piston moves within said strut.

3. The powered closure drive mechanism of claim 2, wherein the lock of said strut comprises:

a driver within said strut; and

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a valve structure within said strut driven by said driver to move between one or more blocking positions in which said strut working fluid is prevented from moving through said restricted orifice structure and one or more non-blocking positions in which said strut working fluid may flow through said restricted orifice structure;

wherein said valve structure is in one of said one or more blocking positions when said lock is in a locking condition.

4. The powered closure drive mechanism of claim 1, wherein a first end of the strut is pivotally connected to the closure and a second end of the strut is connected to said motor via an arm, said motor being fixed relative to said frame.

5. The powered closure drive mechanism of claim 4, further comprising another strut, said other strut being movably mounted between said closure and said frame and having opposite ends moveable toward and away from one another.

6. The powered closure drive mechanism of claim 5, wherein a first end of said other strut is pivotally connected to the closure and a second end of the strut is connected to a second motor via a second arm, said second motor being fixed relative to said frame and being controlled by said controller.

7. The powered closure drive mechanism of claim 1, wherein said dynamic property detector is an accelerometer.

8. The powered closure drive mechanism of claim 7, wherein said accelerometer is mounted on a window provided in said closure.

9. The powered closure drive mechanism of claim 1, wherein said one or more dynamic properties comprise one or more dynamic properties selected from the group consisting of position, inclination, velocity, acceleration, and jerk.

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10. A method of actuating a pivotally-mounted closure supported by a controllable strut having an integral lock, comprising:

moving the controllable strut among angular orientations of the controllable strut relative to the closure and the closure frame to move the strut between opening angular orientations in which the force bias provided by the controllable strut overcomes the weight bias of the closure, causing the closure to move toward an open position, and closing angular orientations in which the force bias provided by the controllable strut is overcome by the weight bias of the closure, causing the closure to move toward a closed position;

monitoring one or more dynamic properties of the closure while the closure moves toward the open and closed positions; and

based upon the monitored dynamic properties of the closure, selectively activating and deactivating the lock of the controllable strut to maintain the controllable strut at least temporarily at particular lengths.

11. The method of claim 10, wherein said lock comprises:

a driver mounted within the controllable strut; and

a valve structure within the controllable strut driven by the driver to move between one or more blocking positions in which a strut working fluid within the controllable strut is prevented from moving through a restricted orifice structure within the strut and one or more non-blocking positions in which the strut working fluid may flow through the restricted orifice structure.

12. The method of claim 10, further comprising moving a second strut among angular orientations of the second strut relative to the closure and the closure frame to move the second strut between opening angular orientations in which the force bias provided by the second strut in combination with the force bias provided by the controllable strut overcomes the weight bias of the closure, causing the closure to move toward an open position, and closing angular orientations in which the force bias provided by the second strut in combination with the force bias provided by the controllable strut is overcome by the weight bias of the closure, causing the closure to move toward a closed position;

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13. The method of claim 12, wherein moving the controllable strut and moving the second strut comprise activating one or more motors coupled to ends of the controllable strut and the second strut, respectively.

14. The method of claim 13, wherein moving the controllable strut and moving the second strut comprise causing coordinated powered movements of the ends of the controllable strut and the second strut in opposite directions for at least a portion of the powered movements.

15. The method of claim 13, wherein moving the controllable strut and moving the second strut comprise causing coordinated powered movements of the ends of the controllable strut and the second strut at different velocities for at least a portion of the powered movements.

16. The method of claim 13, further comprising monitoring one or more motor properties to determine whether an obstruction is present.

17. The method of claim 10, wherein the one or more dynamic properties are one or more properties selected from the group consisting of closure position, closure velocity, closure acceleration, and closure jerk.

18. A rear assembly for a vehicle, comprising:

a rear assembly frame defining an opening;

a closure constructed and arranged to engage and close said opening, said closure being mounted on a generally horizontally-extending hinge for pivotal movement between open and closed positions;

a motor mounted to the rear assembly frame;

a controllable strut having opposite ends moveable in opposite directions toward and away from one another, and having a lock including

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a driver within said controllable strut, and

a valve structure within said controllable strut driven by said driver to move between one or more blocking positions in which a strut working fluid within said controllable strut is prevented from moving through a restricted orifice structure within the strut and one or more non-blocking positions in which said strut working fluid may flow through said restricted orifice structure;

wherein said lock substantially prevents movement of the opposite ends of said strut relative to one another when said lock is in a locking condition and allows movement of the opposite ends of said strut relative to one another when said lock is in a releasing condition, the opposite ends of said strut being biased when said lock is in the releasing condition to move away from one another;

a connecting member pivotally connected to said motor and a first end of said controllable strut, said connecting member being constructed and arranged to move the first end of said controllable strut between opening angular orientations in which the bias of the controllable strut overcomes a weight of the closure so as to move the closure in an opening direction, and closing angular orientations in which the weight of the closure overcomes the bias of the strut so as to move the closure in a closing direction;

a dynamic property detector that detects one or more dynamic properties of the closure; and

a controller operatively connected to said motor, said lock, and said dynamic property detector, said controller controlling said motor and said lock based, at least in part, upon the one or more dynamic properties detected by said dynamic property detector.

19. The rear assembly of claim 18, wherein the dynamic property detector is an accelerometer mounted on said closure.